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[MED 14: Cranes, Lifting Chains and Related Equipment]

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IS 13473 (Part 1) : 1992
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भारतीय मानक

क्रेन – शब्दावली

भाग 1 सामान्य

Indian Standard

CRANES — VOCABULARY

PART 1 GENERAL

UDC 621·873 : 001·4

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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Indian Standard

CRANES — VOCABULARY

PART 1 GENERAL

NATIONAL FOREWORD

This Indian Standard which is identical with ISO 4306-1 : 1990 'Cranes — Vocabulary — Part 1 : General', issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendations of the Cranes, Lifting Chains and its Related Equipment Sectional Committee (HMD 14) and approval of the Heavy Mechanical Engineering Division Council.

This standard is being published in five parts. Other parts of this standard are as follows:

Part 2	Mobile cranes
Part 3	Tower cranes
Part 4	Jib cranes
Part 5	Overhead travelling cranes and portal bridge cranes

Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

ADDITIONAL INFORMATION

ISO 4306-1 is a trilingual edition in English, French and Russian. As the Indian Standard is the national implementation of ISO 4306-1, only the English language text has been retained while adopting it in this standard. For French and Russian texts, reference should be made to the original ISO publication.

The standard on glossary of terms for cranes (IS 5532) was first published in 1969. Consequent on the availability of ISO 4306 (in four parts), IS 5532 was revised to adopt ISO 4306 and was published in four parts under dual number system. ISO 4306 has subsequently been revised. Part 1 of ISO 4306 now covers all parts of IS 5532. Accordingly, IS 5532 is being withdrawn and ISO 4306 (in five parts) is being published again under dual number system.

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Scope

ISO 4306 establishes a vocabulary in English, French and Russian of the most commonly used terms in the field of cranes.

This part of ISO 4306 defines terms concerning the main types of crane, parameters, general concepts and component parts.

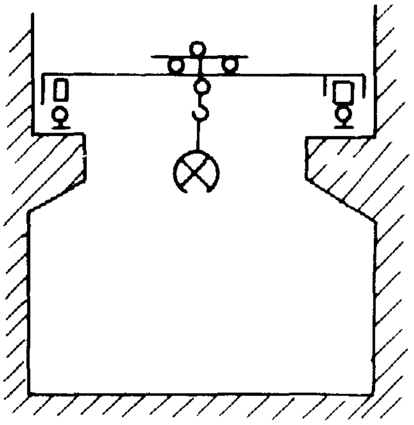
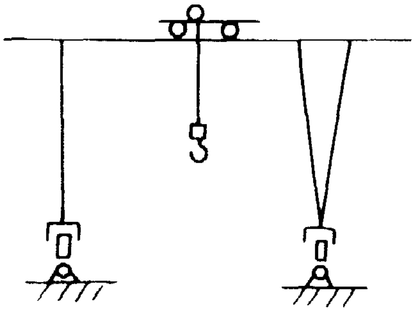
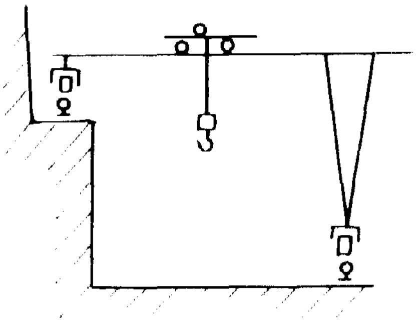
NOTE — Diagrams illustrate some of the definitions and are given only for general guidance.

0 Definition of a crane

crane: Cyclic action machine intended for hoisting and moving in space of a load suspended by means of a hook or other load-handling device.

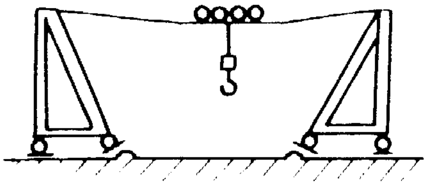
1 Types of crane

1.1 Classification of cranes by construction

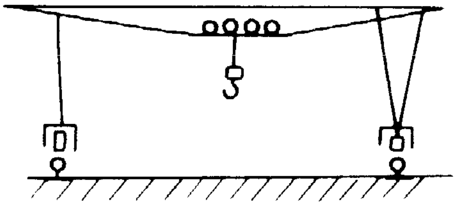
1.1.1 **overhead type crane**: Crane with its load-handling device hung from a crab or a hoist or a jib crane capable of travelling along a bridge.	
1.1.1.1 **overhead travelling crane**: Crane with its bridge girders directly supported on rail tracks by travelling carriages.	
1.1.1.2 **portal bridge crane**: Crane with the bridge girders supported on the rail tracks by legs.	
1.1.1.3 **semi-portal bridge crane**: Crane with its bridge girders supported on the rail track directly at one end and by legs at the other end.	

1.1.2 cable type crane : Crane with a load-handling device suspended from a trolley travelling along track ropes secured to masts.

1.1.2.1 cable crane: Crane whose supporting elements are ropes secured to the tops of supporting masts.

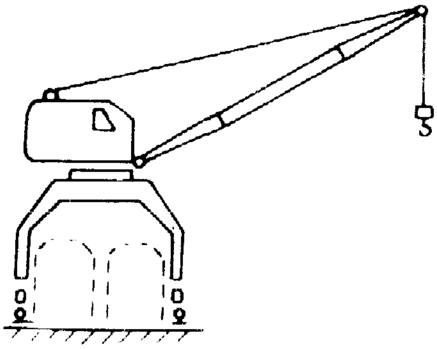


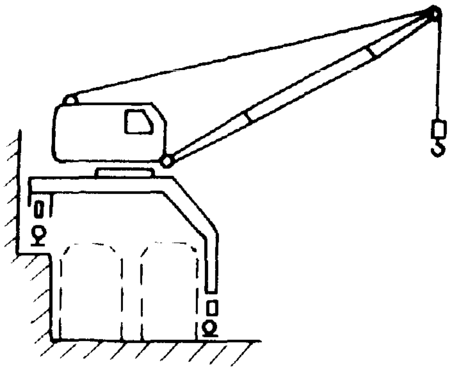
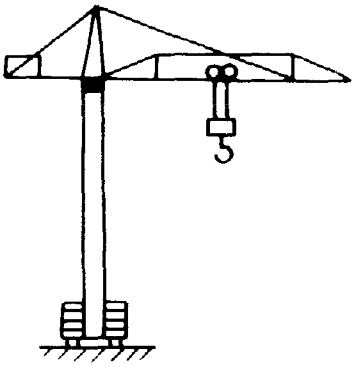
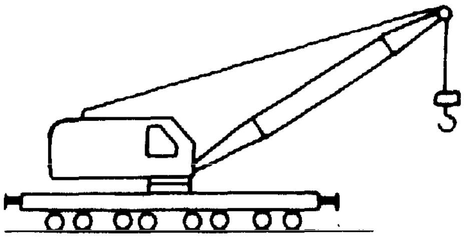
1.1.2.2 portal cable crane: Crane whose supporting elements are ropes secured at the ends of a portal bridge mounted on two legs.



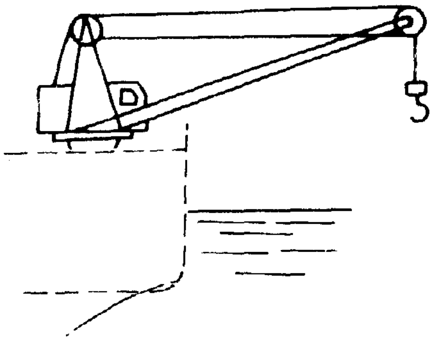
1.1.3 jib type crane: Crane with a load-handling device suspended either from a jib or from a crab travelling along the jib.

1.1.3.1 portal slewing crane: Travelling slewing crane mounted on a portal capable of allowing railcars or road vehicles to pass under it.



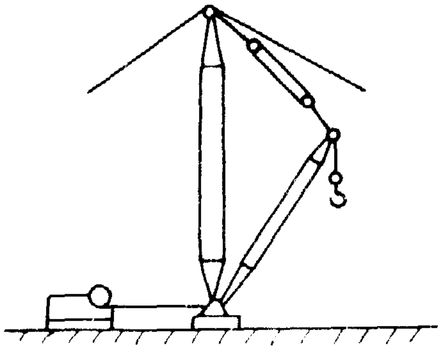
1.1.3.2 **semi-portal slewing crane**: Travelling slewing crane mounted on a semi-portal capable of allowing railcars or road vehicles to pass under it.	
1.1.3.3 **mobile crane**: Jib crane, which may be fitted with a mast (tower attachment), capable of travelling, laden or unladen, without the need for fixed runways and which relies on gravity for stability.	
1.1.3.4 **tower crane**: Slewing jib type crane with jib located at the top of a vertical tower.	
1.1.3.5 **railway crane**: Crane installed on a special platform travelling on railway tracks.	
1.1.3.6 **floating crane**: Crane mounted on a special self-propelled or towed pontoon designed for its support and transport.	

1.1.3.7 **deck crane**: Slewing crane mounted on a ship's deck and intended for loading and unloading the ship.

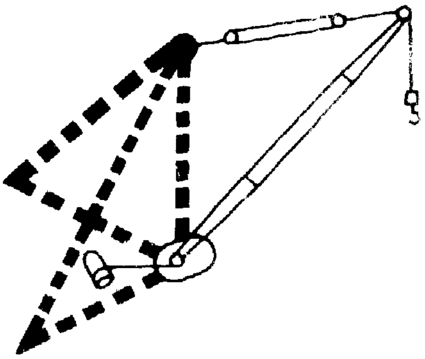


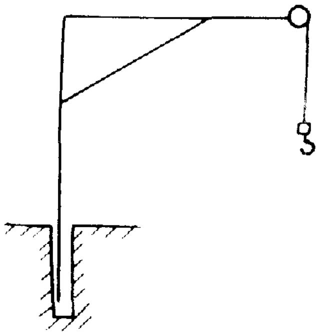
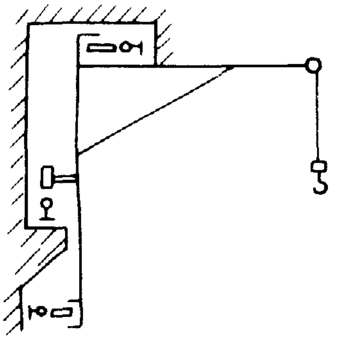
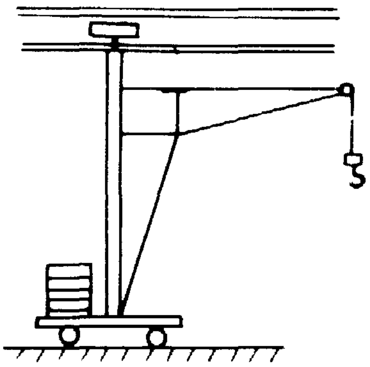
1.1.3.8 **derrick crane (mast crane)**: Slewing crane with a jib hinged at the lower part of a vertical mast which is supported at the top and the bottom.

1.1.3.8.1 **guy-derrick crane**: Derrick crane with the top of the mast held by means of guy ropes.

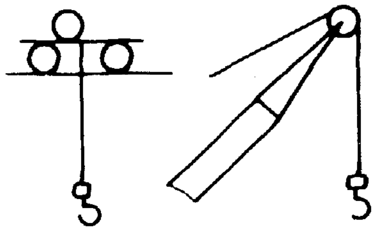
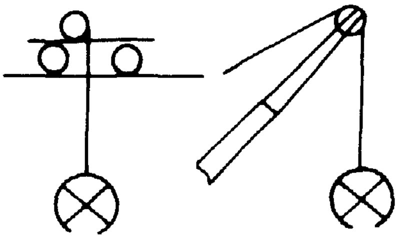
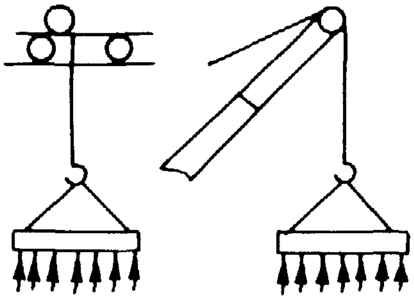
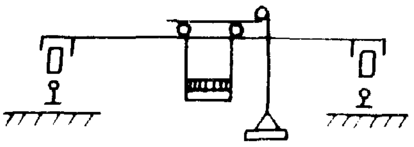
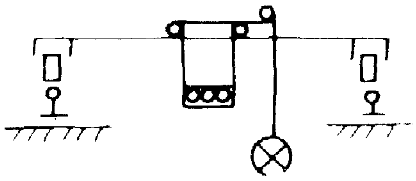


1.1.3.8.2 **rigid-braced derrick crane**: Derrick crane with the top of the mast held by means of rigid bracing.

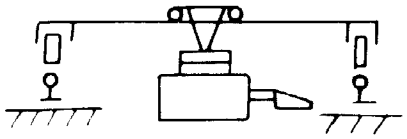


1.1.3.9 **cantilever crane**: Jib crane with a load-handling device suspended either from a rigidly secured cantilever (a jib) or from a crab travelling along the cantilever.	
1.1.3.9.1 **pillar jib crane**: Cantilever crane either capable of rotating on a pillar fixed at its base to a foundation, or secured to a pillar which can rotate in a support socket in its foundation.	
1.1.3.9.2 **wall crane**: Crane either fixed to a wall or capable of travelling on elevated tracks secured to a wall or bearing structure.	
1.1.3.9.3 **walking crane**: Cantilever crane that travels along a ground rail track and is supported by elevated guides.	

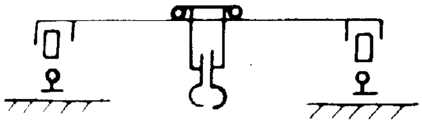
1.2 Classification of cranes by the load-handling device

1.2.1 hook crane: Crane with a hook as the load-handling device.	
1.2.2 grabbing crane: Crane with a grab as the load-handling device.	
1.2.3 magnet crane: Crane with an electromagnet as the load-handling device.	
1.2.4 box-handling crane with magnet: Overhead type crane with an electromagnet as the load-handling device and also having a device for handling charging boxes.	
1.2.5 box-handling crane with grab: Overhead type crane with a grab as the load-handling device and also having a device for handling charging boxes.	

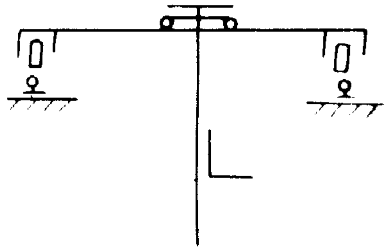
1.2.6 open-hearth furnace charging crane: Overhead type crane equipped with a device for handling charging boxes.



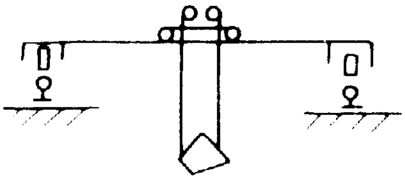
1.2.7 electrode-handling crane: Overhead type crane equipped with a grip for removing electrodes from electrolysers.



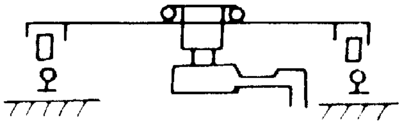
1.2.8 overhead travelling stacking crane: Overhead type crane equipped with a suspended mast carrying the stacking forks.



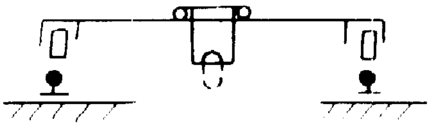
1.2.9 ladle crane: Overhead type crane equipped with mechanisms for lifting and tipping foundry ladles.

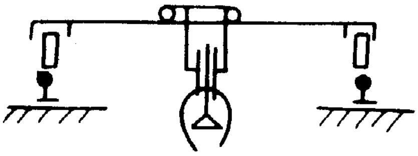
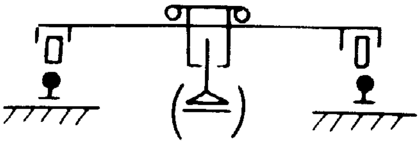


1.2.10 ingot charging crane: Overhead type crane equipped with a slewing column the lower part of which carries horizontal dogs for gripping and charging ingots.

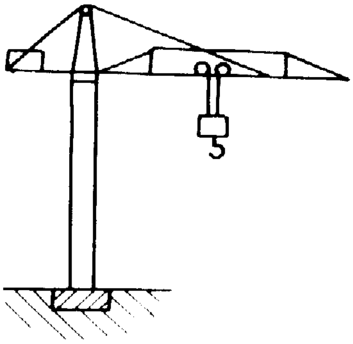
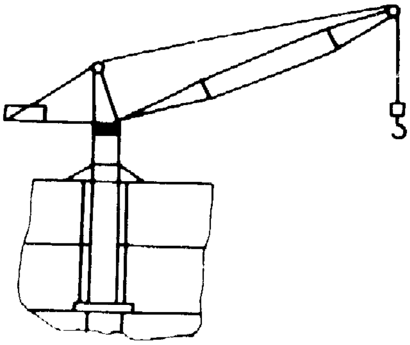


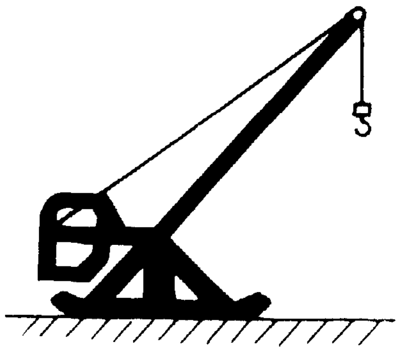
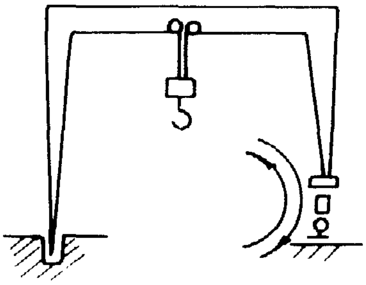
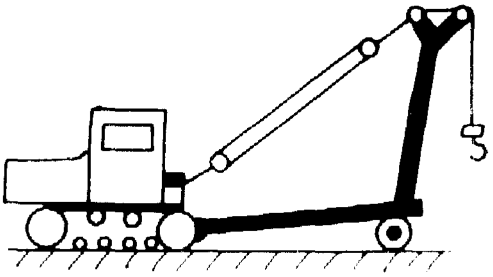
1.2.11 forge crane: Overhead type crane equipped with a device for lifting, handling and turning forgings.



1.2.12 stripper crane: Overhead type crane equipped with a device for removing ingots from moulds.	
1.2.13 soaking pit crane: Overhead type crane equipped with tongs intended for charging the pit furnace.	

1.3 Classification of cranes by the mode of movement

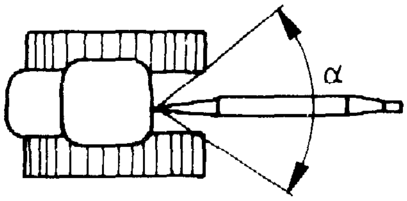
1.3.1 fixed base crane: Crane fixed on a foundation or on any other stationary base.	
1.3.2 climbing crane: Crane mounted on elements of a building being built and travelling upwards by its own mechanisms as the height of the building increases.	

1.3.3 **portable crane**: Crane mounted on a base capable of being moved from site to site manually or by means of auxiliary equipment.	
1.3.4 **radial crane**: Crane capable of moving around a stationary vertical axis in operation.	
1.3.5 **travelling crane**: Crane capable of moving itself during operation.	
1.3.5.1 **self-propelled crane**: Travelling crane equipped with a mechanism for travelling while in operation and for moving from site to site.	
1.3.5.2 **trailer crane**: Travelling crane not provided with power for travelling which can be towed as a trailer by a tractor.	

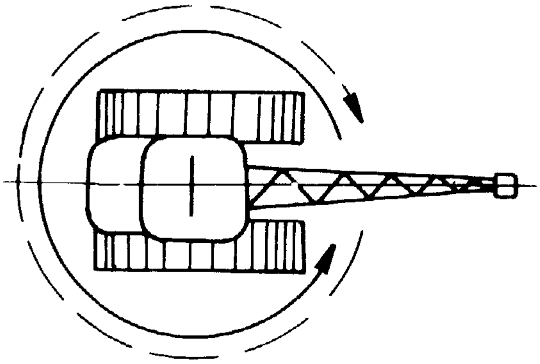
1.4 Classification of cranes by the drive

1.4.1 **manual crane**: Crane with manually-driven mechanisms.	
1.4.2 **electric crane**: Crane with electrically-driven mechanisms.	
1.4.3 **hydraulic crane**: Crane with hydraulically-driven mechanisms.	

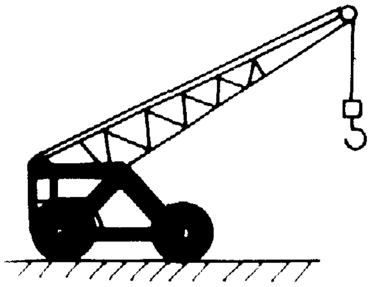
1.5 Classification of cranes by the slewing capabilities

1.5.1 **slewing crane**: Crane with slewing platform capable of rotating with the load in a plane in relation to its undercarriage or base.	
1.5.1.1 **limited slewing crane**: Slewing crane with a slewing platform capable of turning between two extreme positions separated by an angle less than 360°.	

1.5.1.2 full-circle slewing crane: Slewing crane with a slewing platform capable of turning between two extreme positions separated by an angle greater than 360°.

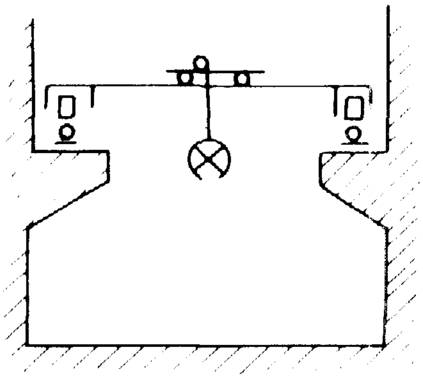


1.5.2 non-slewing crane: Crane not capable of rotating the load in relation to its undercarriage.

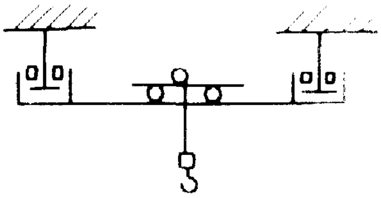


1.6 Classification of cranes by the mode of installation

1.6.1 supported crane: Overhead or underslung crane running on elevated crane track.

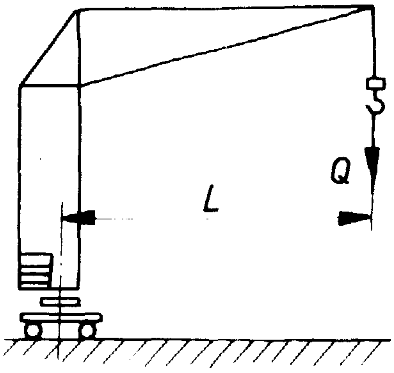
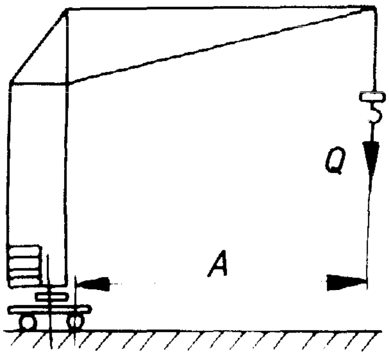


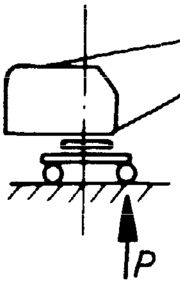
1.6.2 underslung crane: Overhead crane suspended from the lower bar of the crane track.



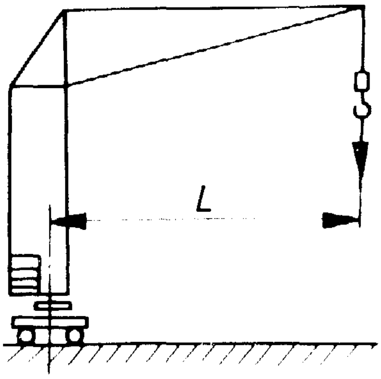
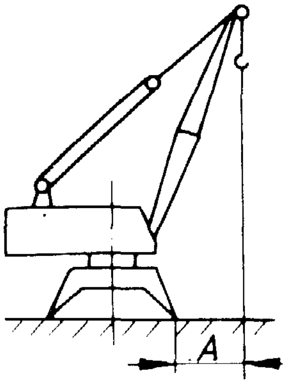
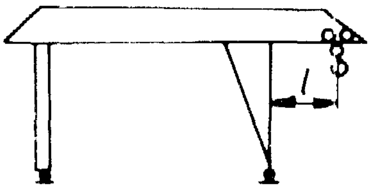
2 Parameters

2.1 Parameters of loads

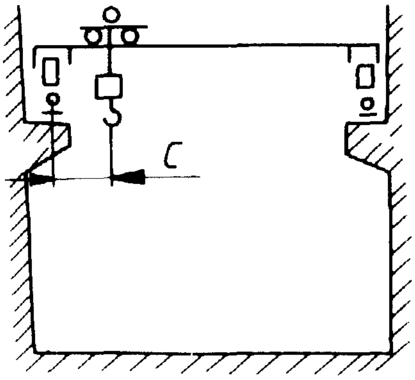
2.1.1 **load moment** $M = L \cdot Q$: Product of radius, L, and its respective load, Q.	
2.1.2 **load tipping moment** $M_A = A \cdot Q$: Product of the distance, A, from the load axis to the tipping axis and its respective load, Q.	
2.1.3 **design mass**, G_k : Mass of a crane without ballast, counterweight, fuel, oils, lubricants and water; for jib cranes, the design mass is to be taken complete with its main jib (boom) and counterweight (tail ballast) but without ballast, fuel, oil, lubricants or water.	
2.1.4 **total mass**, G_o : Mass of the crane including the mass of ballast, counterweight, fuel, oils, lubricants and water filled to the recommended levels.	

2.1.5 wheel load, *P* : Maximum vertical load transferred by one chassis wheel to the track or ground.	

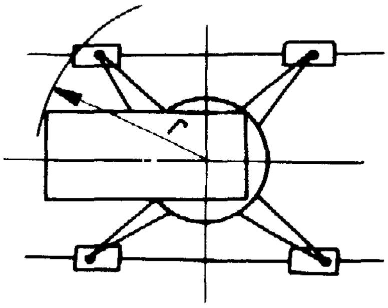
2.2 Linear parameters of cranes

2.2.1 radius, *L* : Horizontal distance between the axis of slewing of the turntable of the crane and the vertical axis of an unladen load-handling device when the crane is erected on a level site.	
2.2.2 outreach to tipping axis, *A* : Horizontal distance from the tipping axis to the vertical axis of the load-handling device measured under no-load conditions and when the crane is erected on a level site.	
2.2.3 outreach from rail, *l* : Maximum horizontal distance between the axis of the crane rail closest to the cantilever and the axis of the load-handling device when located on the cantilever.	

2.2.4 **hook approach,** *C* : Minimum horizontal distance between the centre of the track rail and the vertical axis of the load-handling device.



2.2.5 **tail radius,** *r* : Maximum radius of the slewing part of the crane that lies opposite to the boom.

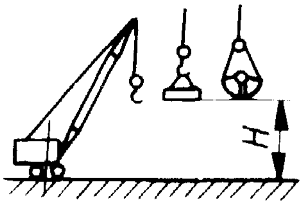


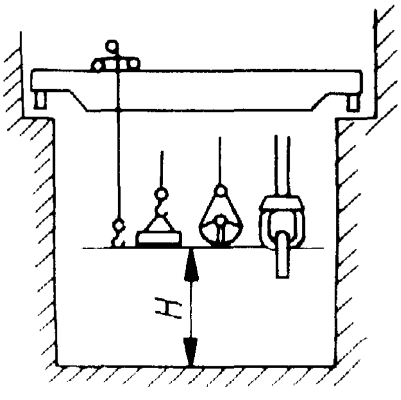
2.2.6 **load-lifting height,** *H* : Vertical distance from the level of the plane on which the crane is resting up to the load-handling device when it is located at its uppermost working position:

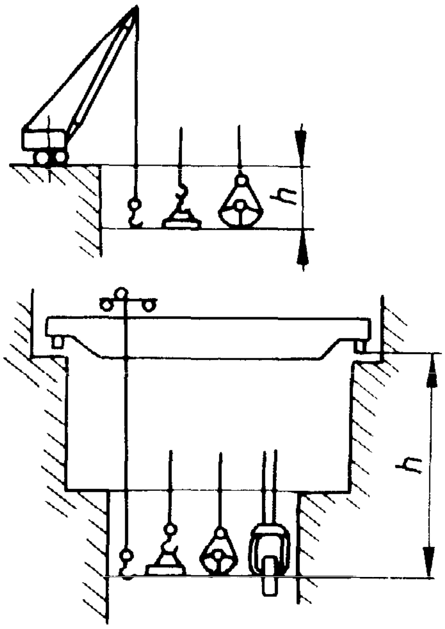
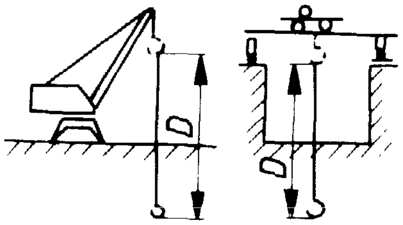
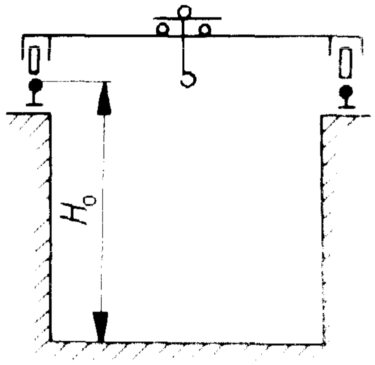
— for hooks and forks, up to their bearing surface;

— for other load-handling attachments, up to their lowest point (when closed).

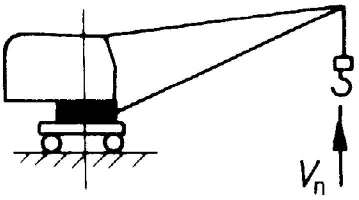
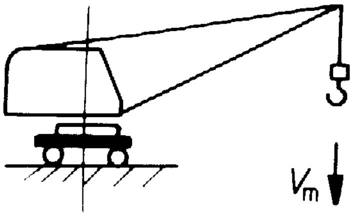
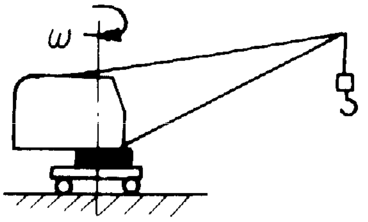
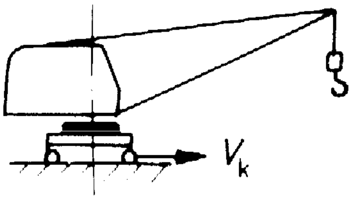
For overhead type cranes, the lifting height is to be measured from the ground level. The lifting height is to be determined without load, the crane being erected on a level site.



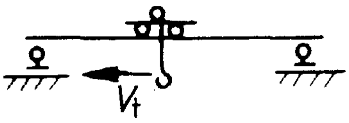


2.2.7 load-lowering height, h : Vertical distance between the crane bearing level and the load-handling device located at its lowest working position: — for hooks and forks, up to their bearing surface; — for other load-handling attachments, up to their lowest point (when closed). For overhead type cranes, the load-lowering height is to be measured up to the rail level. The load lowering height is to be determined without any load, the crane being erected on a level site.	
2.2.8 lifting range, D : Vertical distance between the highest and the lowest working positions of the load-handling device [$D = H + h$ (*see* 2.2.6 *and* 2.2.7)].	
2.2.9 crane track height, H_0 : Vertical distance between the ground (floor) level and the rail head level of the crane track.	

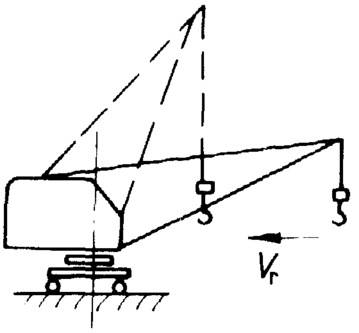
2.3 Speeds of working motion

2.3.1 **load-lifting (-lowering) speed,** V_n : Rate of vertical displacement of the working load under steady conditions of motion.	
2.3.2 **precision load-lowering speed,** V_m : Slowest lowering speed of maximum working load that can be attained during erection or stacking operations under steady conditions of motion.	
2.3.3 **slewing speed,** ω : Angular slewing speed of turntable of the crane under steady conditions of motion. It is determined at maximum radius at the working load with the crane on a level site and a wind speed under 3 m/s at a height of 10 m.	
2.3.4 **travelling speed,** V_k : Rate of travel of a crane under steady conditions of motion. It is determined when the crane travels on a horizontal path with its working load and at a wind speed under 3 m/s at a height of 10 m.	

2.3.5 **crab traversing speed,** V_t : Rate of traverse of the crab under steady conditions of motion. It is determined when the crab moves on a horizontal path under the maximum working load and at a wind speed under 3 m/s at a height of 10 m.

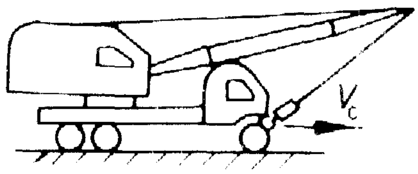


2.3.6 **derricking speed,** V_r : Average rate of horizontal displacement of the working load under steady conditions of motion. It is determined when the radius changes from the maximum to minimum values, the crane standing on a level path and at a wind speed under 3 m/s at a height of 10 m.



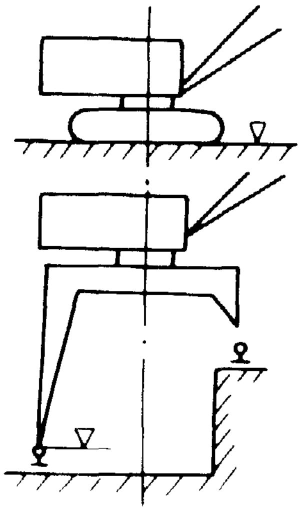
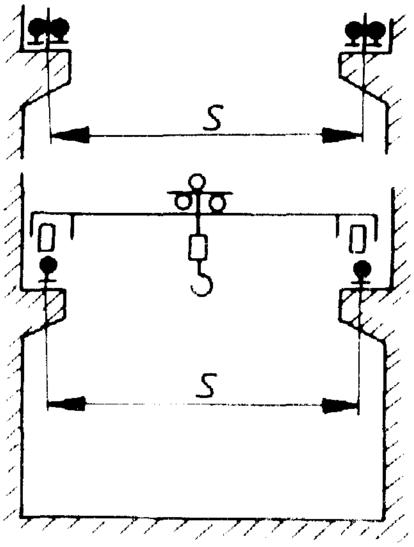
2.3.7 **derricking time,** t : Time needed to change the radius from its maximum to its minimum value. It is determined with a load equal in weight to the load-lifting capacity at the maximum radius, the crane standing on a level path and at a wind speed under 3 m/s at a height of 10 m.

2.3.8 **transport (road) speed,** V_c : Maximum speed at which a crane can travel in its transport position under its own power.



2.3.9 **operation cycle time**: Time required to complete one cycle of operations as specified.	

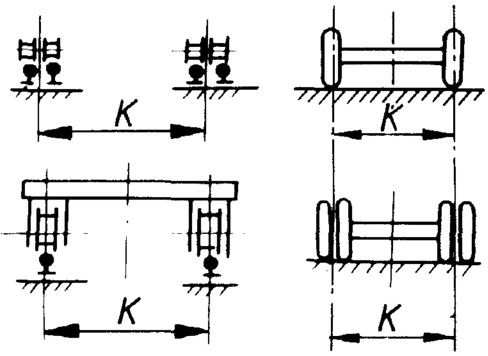
2.4 Parameters associated with track

2.4.1 **crane datum level**: Horizontal surface of the foundation or the rail head on which the crane undercarriage rests. When the support rails or tracks are on different levels, then the crane bearing level is to be reckoned from the lower rail or track.	
2.4.2 **span**, S : For overhead type cranes; the horizontal distance between the centres of the crane track rails.	

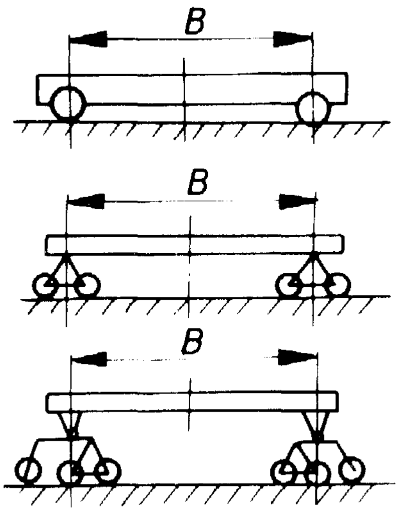
2.4.3 track centres, K :

a) For jib cranes; the horizontal distance between the centres of rails or tread centres of the crane undercarriage.

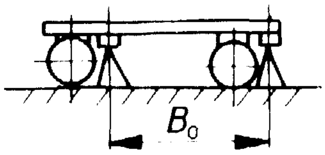
b) For crabs; the distance between the centres of the track rails.



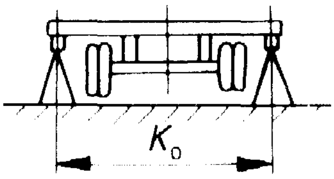
2.4.4 base, B : Distance between the axes of the crane supports as measured along the axis parallel to the longitudinal movement of the crane.



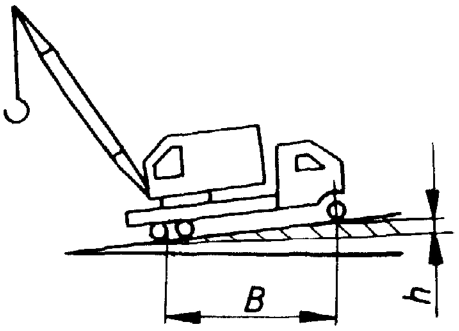
2.4.5 base on outriggers B_0 : Distance between vertical axes of outriggers as measured parallel to the longitudinal movement of the crane.



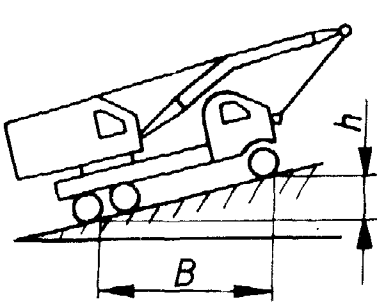
2.4.6 distance between outriggers, K_0 : Distance between vertical axes of outriggers as measured across the axis perpendicular to the longitudinal movement of the crane.



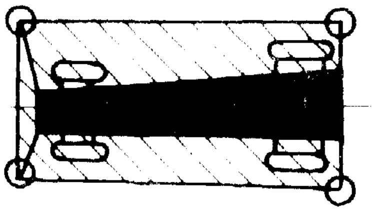
2.4.7 **gradient,** i : Gradient that the crane can climb determined by the ratio $i = \frac{h}{B}$, expressed as a percentage, corresponding to the difference h in the levels of two points on the slope at a horizontal distance B related to the base of the crane. The magnitude of the difference in levels is to be measured when there is no load on the track.



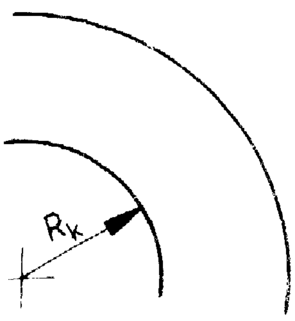
2.4.8 **gradeability**: Maximum angle of the slope $j = \frac{h}{B}$, expressed as a percentage, that the unloaded crane can climb at a constant transport speed.



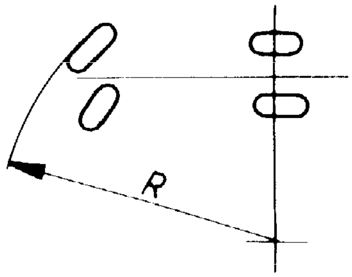
2.4.9 **support contour**: Contour formed by the horizontal projection lines that connect the vertical axes of support elements of the crane, such as wheels or outriggers.



2.4.10 **track curvature radius,** R_k: Minimum radius of curvature of the crane track inside rail on a curved track.



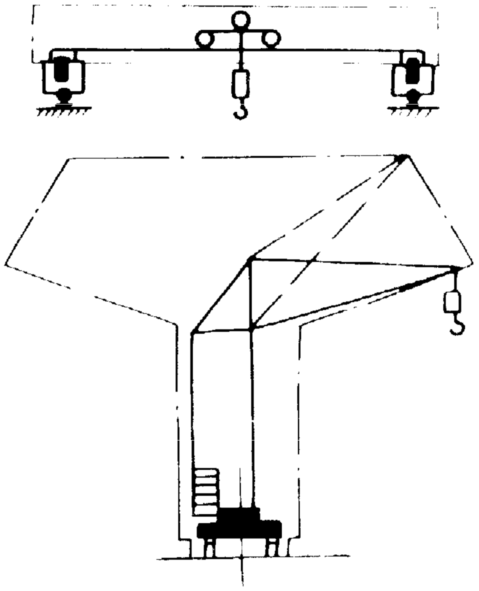
2.4.11 minimum turning radius, *R* **:** Radius of circumference circumscribed with the outside front wheel of the crane when the wheels are on full lock.



2.5 General parameters

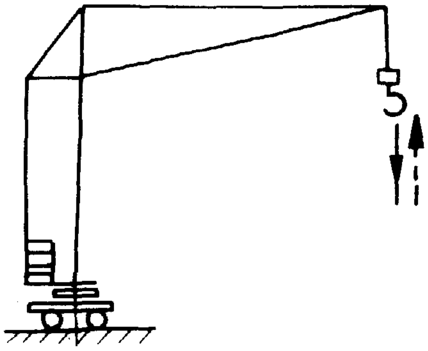
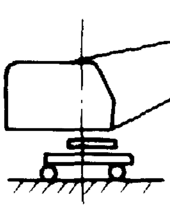
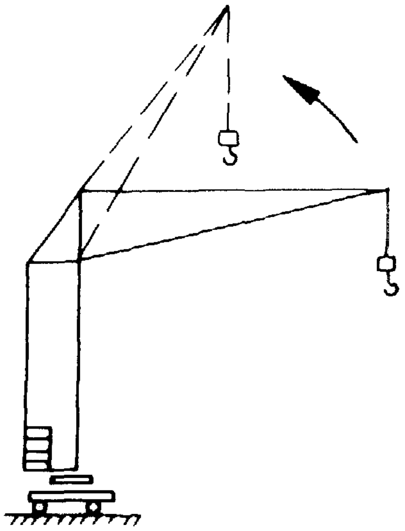
2.5.1 classification group: Classification of the machine taking account of the crane use with respect to the load-lifting capacity, duration and frequency of operation.

2.5.2 crane clearance line: Space, restricted by the conditions of safe operation of the crane near objects, the limits of which can be crossed only by the load-handling device in executing the handling operations.

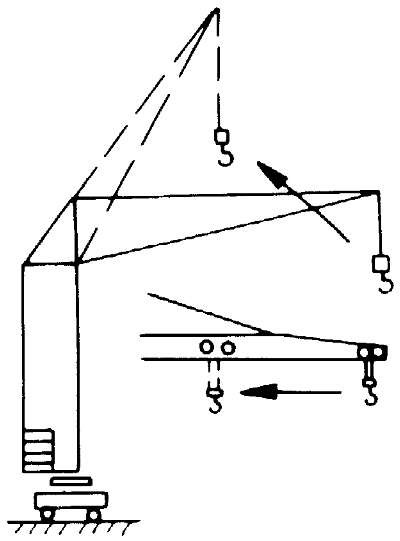


3 General concepts

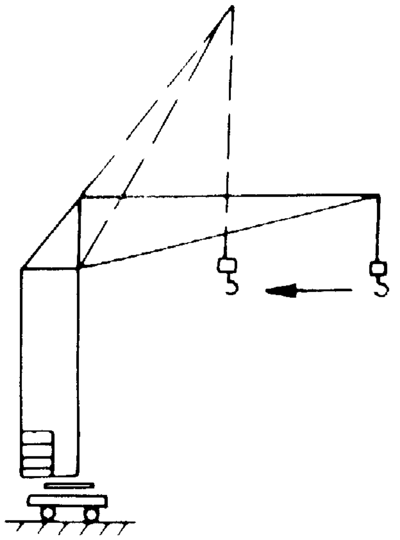
3.1 Motions

3.1.1 lifting (lowering) of load: Displacement of a load in a vertical direction.	
3.1.2 precision load-lowering: Lowering of a load at minimal speed in the course of erection or stacking operations (see 2.3.2).	
3.1.3 derricking (luffing): Angular motion of the jib in a vertical plane.	

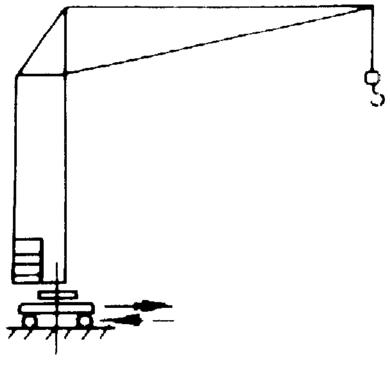
3.1.4 change in radius: Moving the load-handling device by lowering, lifting or travelling the jib (boom) or by moving the crab.

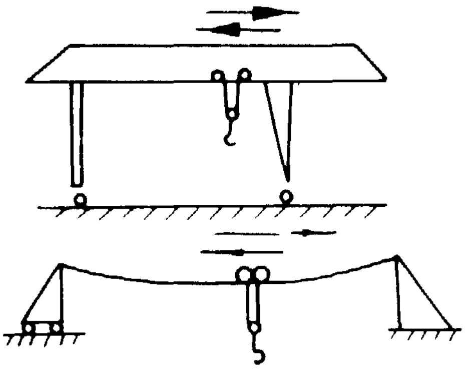
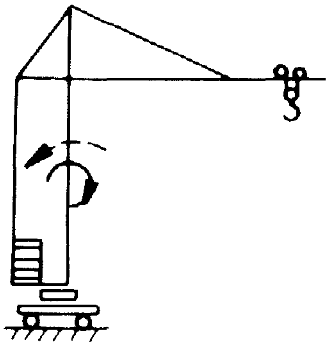


3.1.4.1 level luffing: Luffing motion during which the load is automatically maintained at an approximately constant height.



3.1.5 travelling: Movement of the crane as a whole when in its operational form.



3.1.6 **traversing (direction)**: Movement of the crab along the bridge, track ropes, jib or cantilever.	
3.1.7 **slewing**: Angular motion of the revolving part in the horizontal plane of a bridge, portal or cantilever crane.	

3.2 Crane stability

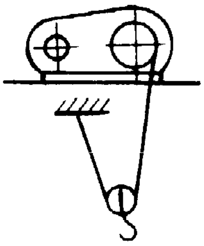
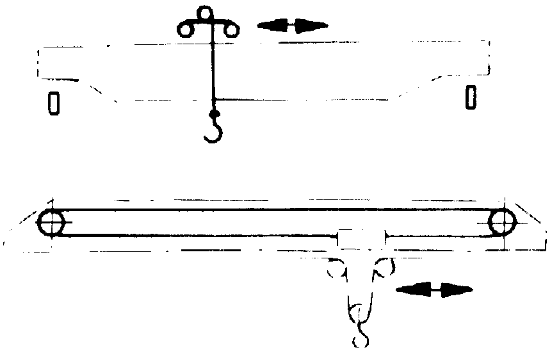
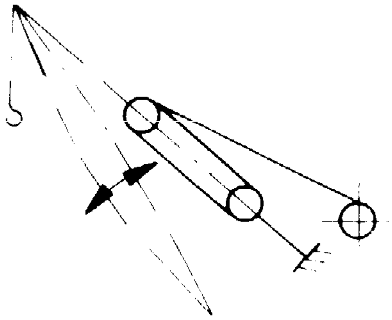
3.2.1 **crane stability**: Ability of crane to resist tipping moments.	
3.2.2 **stability under working conditions**: Ability of crane to resist tipping moments induced by the weight of the load Q, inertia forces I, wind load and other causes.	

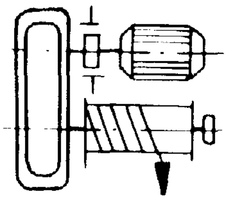
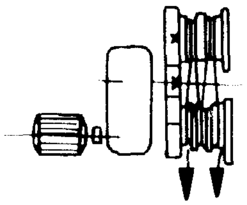
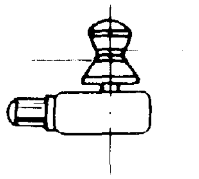
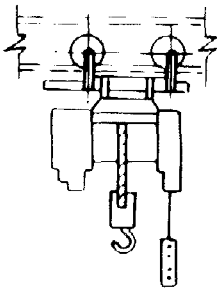
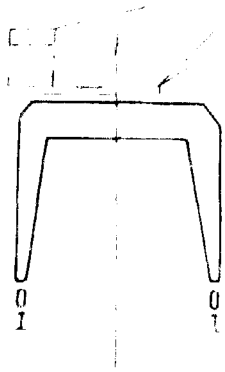
3.2.3 **stability under no-load condition (crane assembled)**: Ability of crane to resist tipping moments induced by wind load and other causes when the crane is not in operation.	

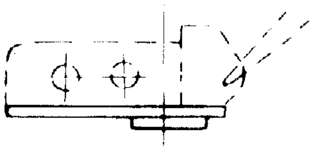
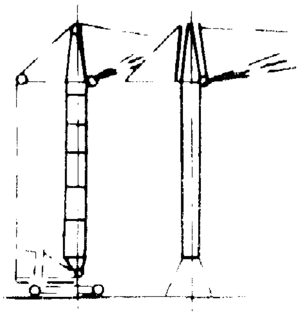
3.3 Tests

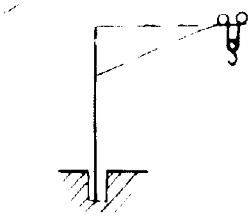
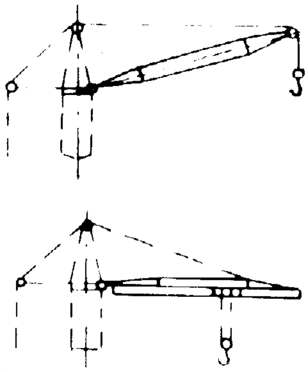
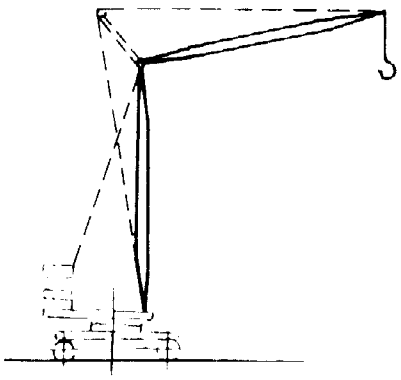
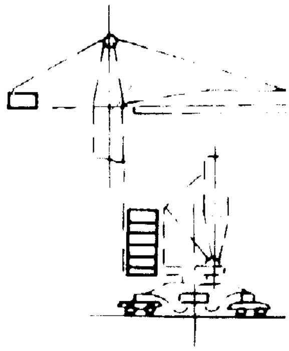
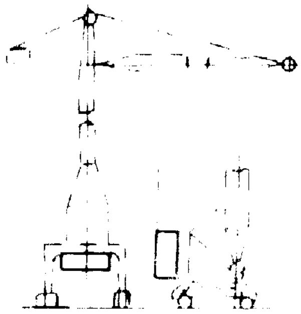
3.3.1 **static tests**: Testing of a crane by applying a static load at the load-handling device, exceeding by *X* % the load-lifting capacity of the crane.	
3.3.2 **dynamic tests**: Testing of a crane by executing operating motions under a load exceeding by *Y* % the load-lifting capacity of the crane.	

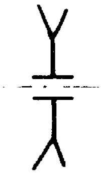
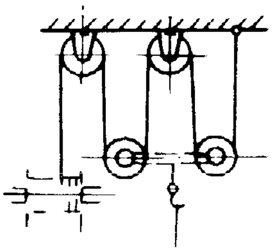
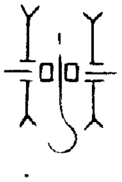
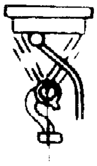
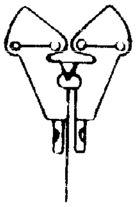
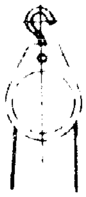
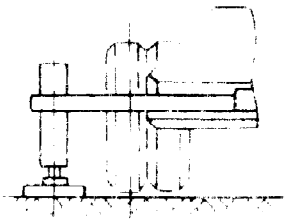
4 Component parts

4.1 hoisting mechanism: Drive mechanism for lifting and lowering the load.	
4.2 crane travel mechanism: Drive unit for moving the crane.	
4.3 crab or hoist traverse mechanism: Drive unit for moving the crab or hoist.	
4.4 derricking mechanism: Drive unit for changing the radius and load-lifting height by varying the jib and/or fly jib inclination.	
4.5 slewing mechanism: Drive unit for rotating the revolving part of the crane in a horizontal plane.	

4.6 **winch**: Mechanism which transmits pull by means of a flexible element (rope, chain) from a power-driven drum: — drum hoist; — friction hoist; — capstan.	  
4.7 **hoist**: Load-lifting mechanism mounted with or without the traverse drive as a single unit.	
4.8 **undercarriage**: Base of the crane for mounting the rotating platform or crane tower including drive gear to move the crane.	
4.9 **portal**: Structure having an elevated bridge supported by legs with or without running gear at ground level.	

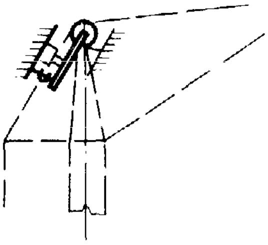
4.10 **bogie**: Supporting assembly equipped with wheels or rollers and articulated to equalize the wheel or roller loads.	
4.11 **bridge**: Main supporting structure of overhead type cranes over which the crab traverses, or the structure between supports on portal and semi-portal cranes.	
4.12 **crab (trolley)**: An assembly designed to traverse the suspended load.	
4.13 **slewing ring**: Component part intended for transferring the load (load moment, vertical and horizontal forces) from the rotating part to the stationary part; it may also incorporate the slewing gear ring for rotating the revolving part of the crane.	
4.14 **rotating platform**: Rotating structure of the crane carrying the crane mechanisms.	
4.15 **tower**: Vertical structure of a crane which supports the jib and/or rotating platform and provides the necessary height to the position of the jib foot.	

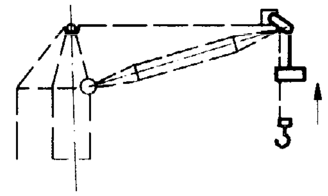
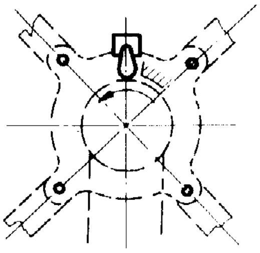
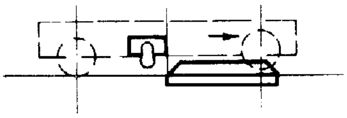
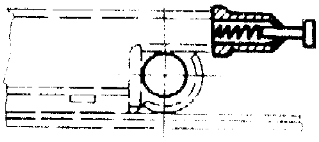
4.16 **pillar**: Vertical column supporting a rotating jib and its load and providing the necessary lifting height.	
4.17 **jib (boom)**: Component of a crane which provides the necessary radius and/or height of the load-handling device.	
4.18 **mast (tower) attachment**: Alternate attachment for a mobile crane consisting of a mast (tower) jib, with or without fly jib, and necessary accessories.	
4.19 **counterweight**: Weights attached to the counterweight cantilever or to the rotating platform to assist in counteracting the weight of the working load and/or certain parts of the crane during operation.	
4.20 **ballast**: Weight attached to the undercarriage or portal to ensure the stability of the crane.	

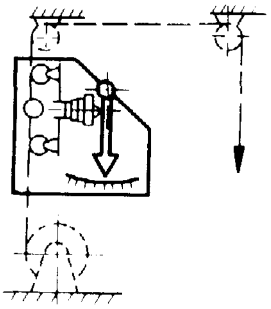
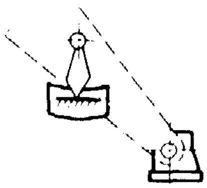
4.21	**brake** : Device for reducing the speed or stopping and/or preventing movement of the crane mechanisms.	
4.22	**sheave (pulley)**: Rotating element with one or more grooves for guiding and/or changing the direction of the rope (chain).	
4.23	**reeving system**: System consisting of sheaves and ropes for changing forces and speeds.	
4.24	**hook assembly**: System of sheaves mounted in a frame with a hook attached to it.	
4.25	**load handling device**: Device (hook, grab, electromagnet, fork or other) for grabbing, holding or handling the load.	  
4.26	**outrigger**: Device intended to increase the supporting base of the crane in its operating condition	

5 Limiting and indicating devices

5.1 Rated capacity and motion limiting and indicating devices

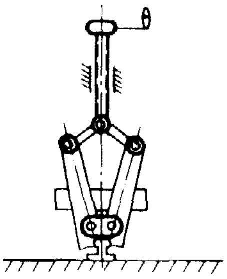
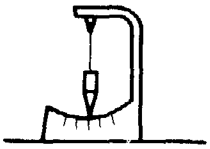
5.1.1 **limiting device (limiter)**: Device which initiates stopping or restricting crane motion or function. The majority of these devices will operate automatically when the respective motion or function reaches its limiting position.	
5.1.2 **function limiter**: Limiting device which initiates the stopping and/or restriction of designated crane function(s).	
5.1.3 **Rated capacity limiters**	
5.1.3.1 **rated capacity limiter**	

5.1.4 **Motion limiters**	
5.1.4.1 **motion limiter**: Limiting device which initiates either the stopping and/or restriction of designated crane motion.	
5.1.4.2 **hoisting limiter**	
5.1.4.3 **lowering limiter**	
5.1.4.4 **slewing limiter**	
5.1.4.5 **crane travelling limiter**	
5.1.4.6 **crab traversing limiter**	
5.1.4.7 **derricking (luffing) limiter**	
5.1.4.8 **buffer**: Shock-absorbing device.	

5.1.5 **indicating device (indicator)**: Device which provides the crane driver with audible and/or visual data for competent control of the crane within its operating parameters.	
5.1.6 **operating pårameter indicator**: Device which provides the crane driver with audible and/or visual data on values of operating parameters.	
5.1.7 **rated capacity indicator**	
5.1.8 **Motion indicators**	
5.1.8.1 **radius indicator**	
5.1.8.2 **jib angle indicator**	

5.2 Performance limiting and indicating devices

5.2.1 **Performance limiters**	
5.2.1.1 skew limiter	
5.2.1.2 rope winding limiter	
5.2.1.3 rope unwinding limiter	
5.2.1.4 slewing speed limiter	
5.2.1.5 hoisting (lowering) speed limiter	
5.2.1.6 crane travelling speed limiter	
5.2.1.7 crab traversing speed limiter	
5.2.1.8 relief valve (in hydraulic svstem)	

5.2.1.9 **rail clamp**: Device which can be tightened to the rail to prevent a rail-mounted crane being blown along the track when not in use.	
5.2.2 **Performance indicators**	
5.2.2.1 **skew indicator**	
5.2.2.2 **crane slope indicator**	
5.2.2.3 **drum rotation indicator**	
5.2.2.4 **slack rope indicator**	

5.3 Environment limiting and indicating devices

(Under study)

5.4 Other limiting and indicating devices

(Under study)

6 Lifted loads

6.1 Terms, definitions and symbols

6.1.1 **payload**: Load, having mass m_{PL}, which is lifted by the crane and suspended from the non-fixed load-lifting attachment(s) or, if such an attachment is not used, directly from the fixed load-lifting attachment(s). If cranes are used for lifting gates at hydro-power stations or for lifting the load from water, the payload may also include forces due to waterflow suction or water adhering by suction.	
6.1.2 **non-fixed load-lifting attachment**: Any equipment, having mass m_{NA}, which connects the payload m_{PL} with the crane and which is a part of neither the crane or the payload. Non-fixed load-lifting attachments are easily detachable from the crane and from the payload.	

6.1.3 **net load**: Load, having mass m_{NL}, which is lifted by the crane and suspended from the fixed load-lifting attachment(s). Mass m_{NL} is the sum of the payload m_{PL} and the non-fixed load-lifting attachment(s) m_{NA}:

$$m_{NL} = m_{PL} + m_{NA}$$

6.1.4 **fixed load-lifting attachment**: Any equipment, having mass m_{FA}, from which the net load may be suspended and which is permanently fastened to the lower end(s) of the hoist medium(s). Fixed load-lifting attachments are part of the crane.

6.1.5 **hoist medium load**: Load, having mass m_{HL}, which is lifted by the crane and suspended from the lower end(s) of the hoist medium. Mass m_{HL} is the sum of the payload m_{PL}, the non-fixed load-lifting attachment(s) m_{NA} and the fixed load-lifting attachment m_{FA}:

$$m_{HL} = m_{PL} + m_{NA} + m_{FA}$$

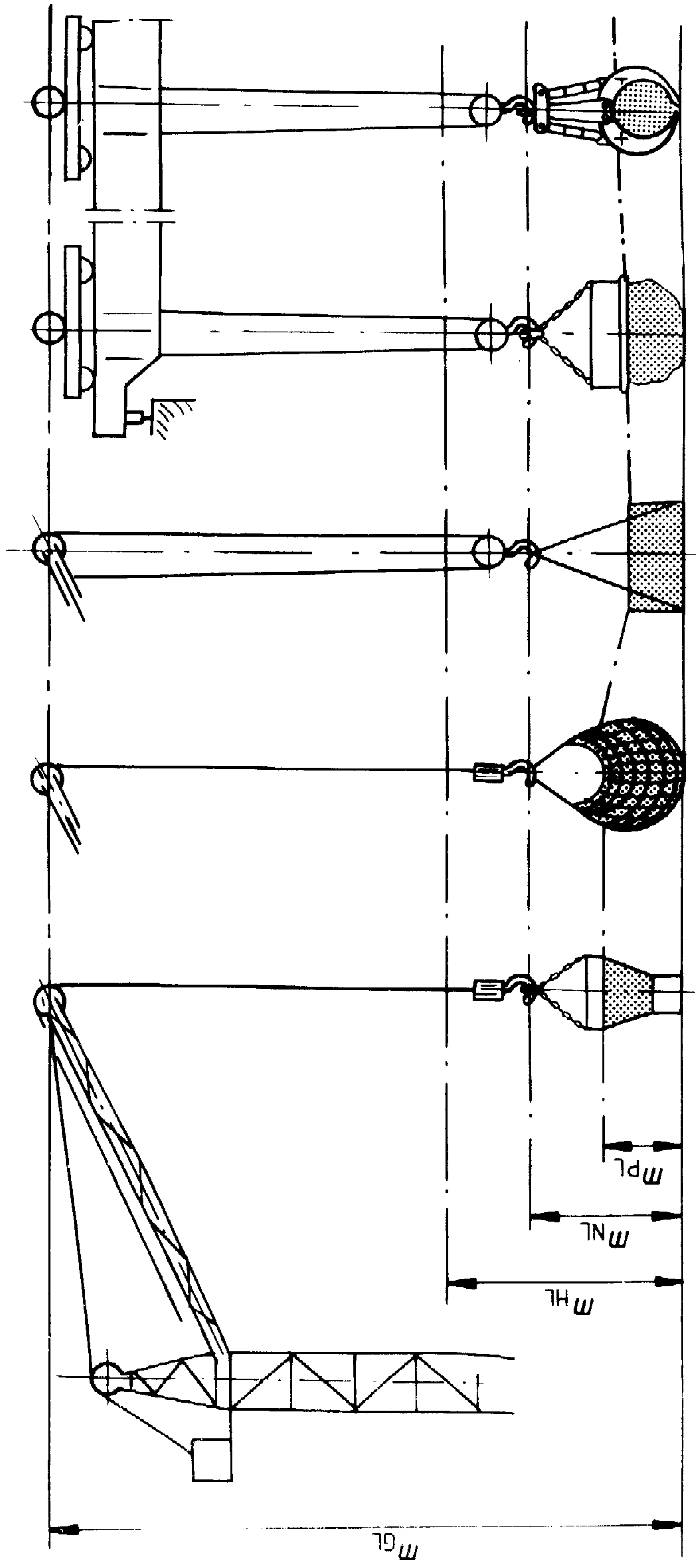
6.1.6 **hoist medium**: Wire rope(s), chain(s) or any other equipment, having mass m_{HM}, hanging down from the crane, for example from the crab or the jib head, operated by a winch, etc., to lift and lower loads suspended from the lower end(s) of the hoist medium(s). Hoist mediums are part of the crane.

6.1.7 **gross load**: Load, having mass m_{GL}, which is suspended directly from the crane, for example from the crab or the jib head. Mass m_{GL} is the sum of the payload m_{PL}, the non-fixed load-lifting attachment(s) m_{NA}, the fixed load-lifting attachment(s) m_{FA} and the hoist medium(s) m_{HM}:

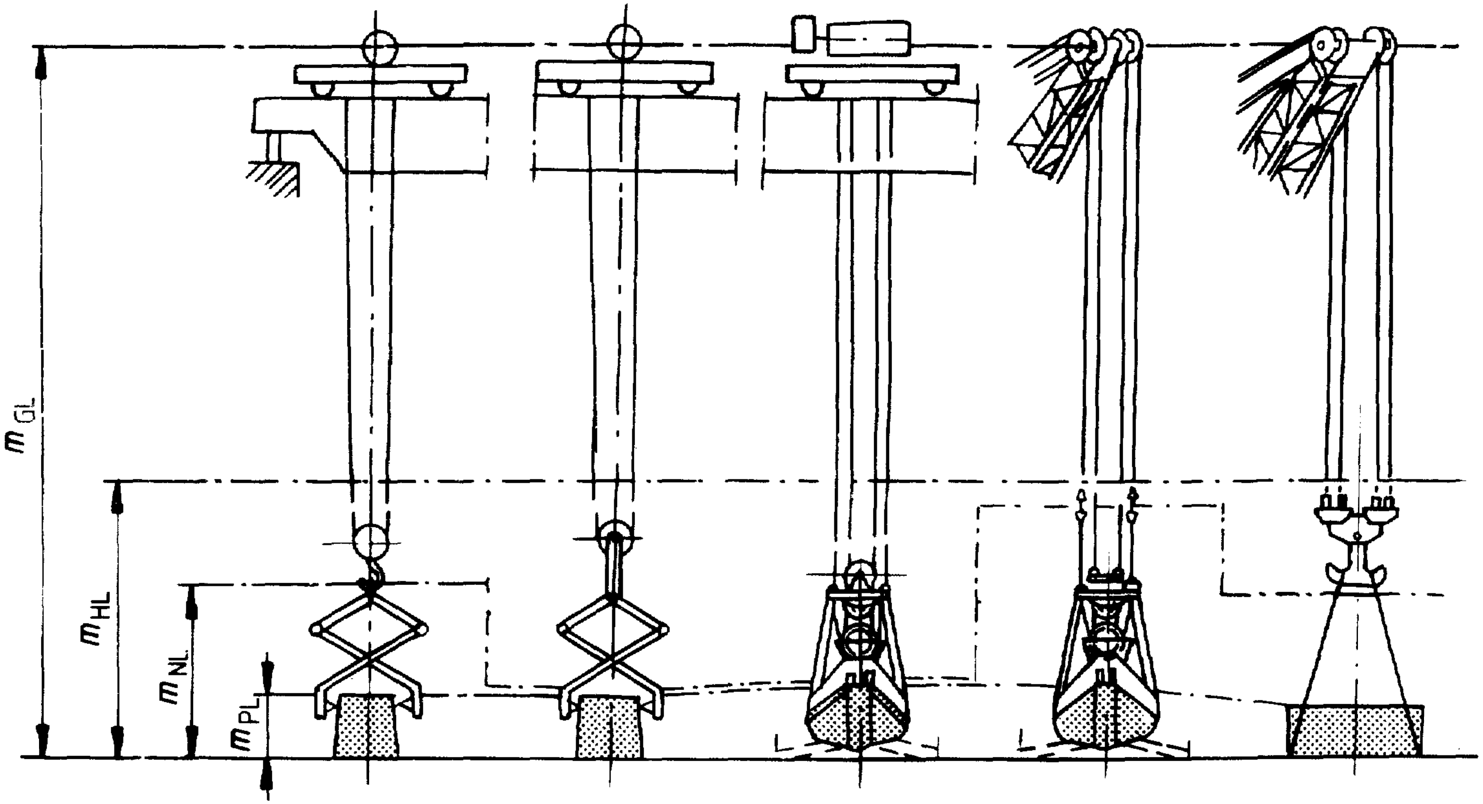
$$m_{GL} = m_{PL} + m_{NA} + m_{FA} + m_{HM}$$

6.2 Examples of use of terms and symbols

Examples of use of terms and symbols for crane loads are given in the following four figures.


m_{PL}
m_{NL}
m_{HL}
m_{GL}

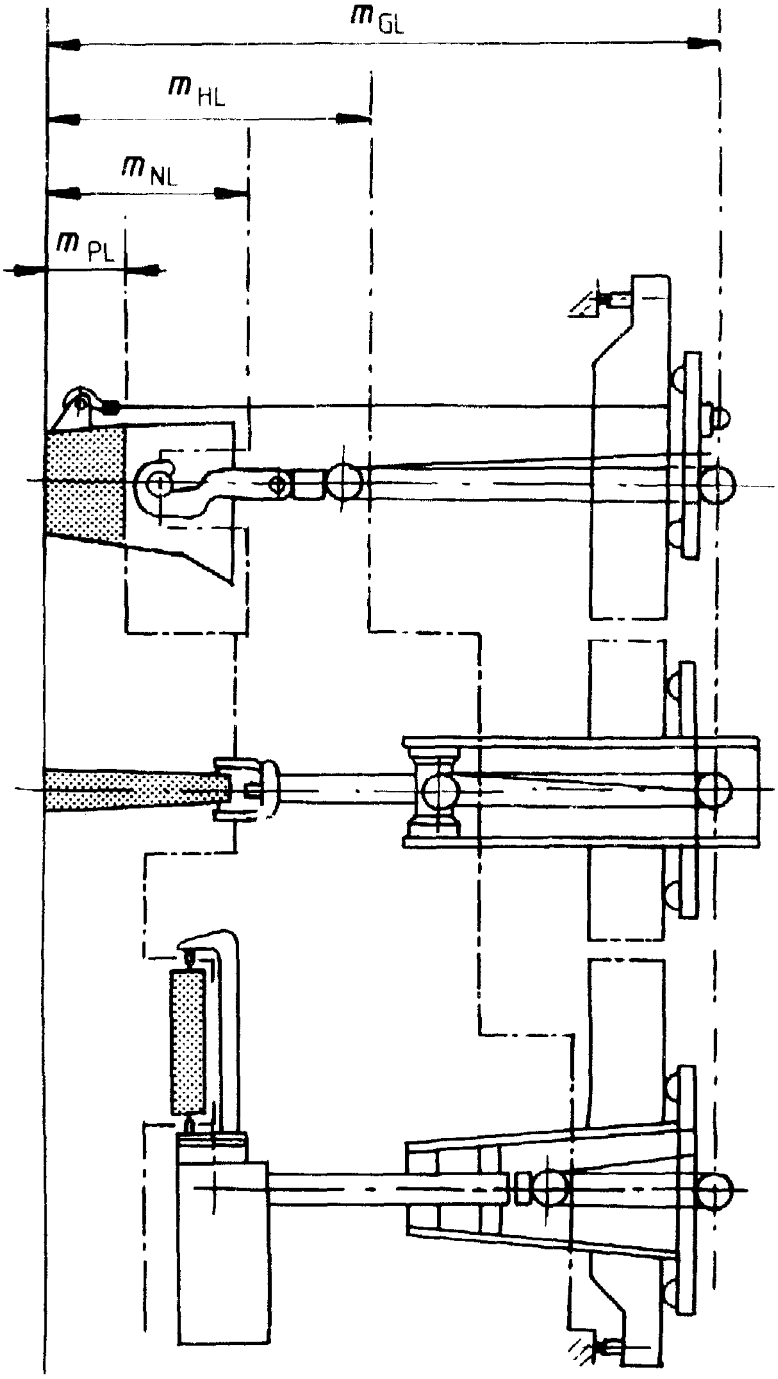
Gross load	Hoist medium			m_{HM}	**Hoist rope hanging down from jib head**			**Hoist rope hanging down from crab**	
	Hoist medium load	Fixed load-lifting attachment(s)		m_{FA}	Hook assembly	Hook assembly	Bottom block	Bottom block	Bottom block
		Net load	Non-fixed load-lifting attachment(s)	m_{NA}	Skip and chain	Net	Rope slings	Electromagnet and chain	Grab
			Payload	m_{PL}	Contents of skip	Contents of net	Box and contents	Scrap iron	Contents of grab
m_{GL}	m_{HL}	m_{NL}							


m_{GL}
m_{HL}
m_{NL}
m_{PL}

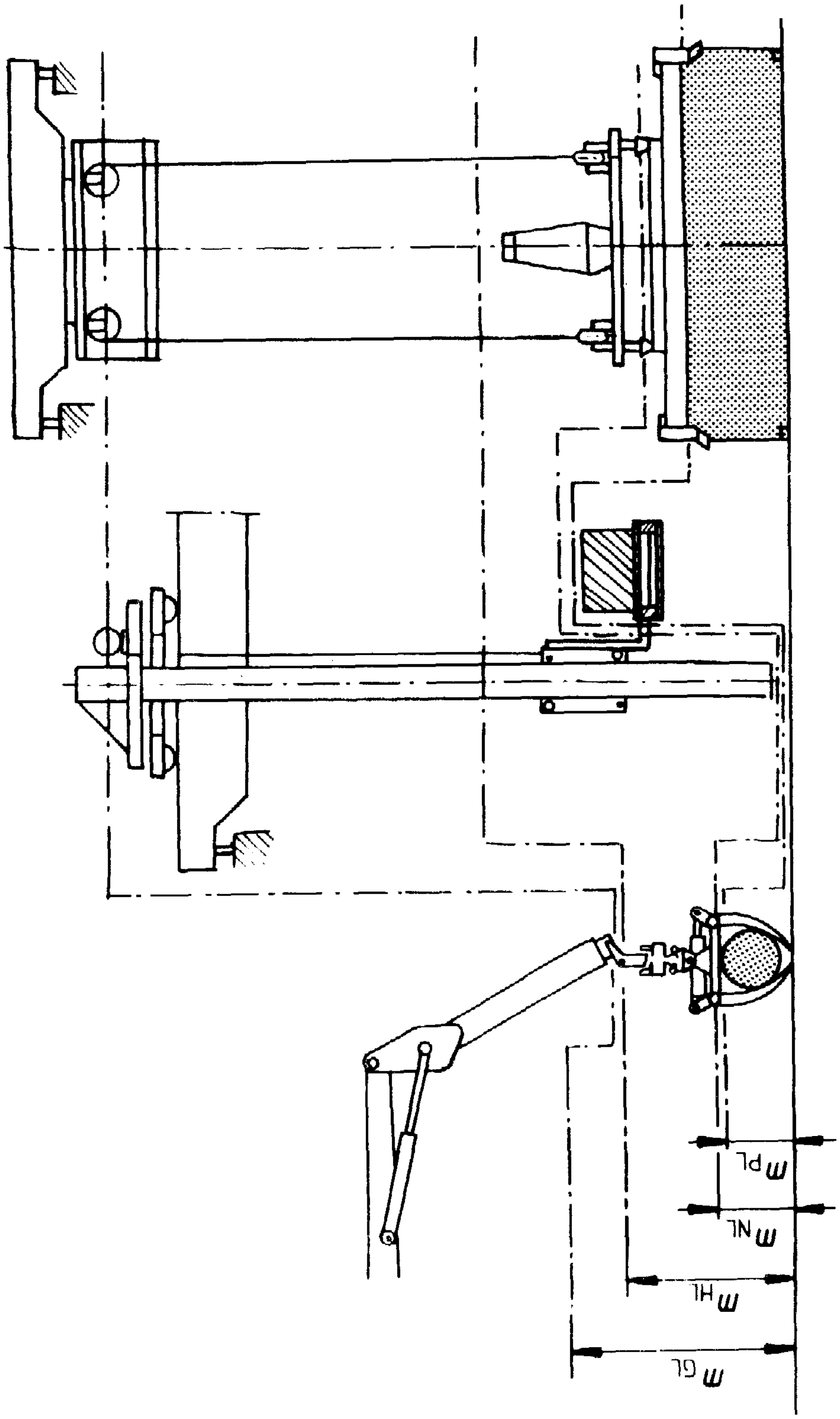
Gross load			Hoist medium	m_{HM}	Hoist rope hanging down from crab			Hoist rope hanging down from jib head	
	Hoist medium load		Fixed load-lifting attachment(s)	m_{FA}	Bottom block	Gripping device and sheave[1]	Grab[1]	—	—
		Net load	Non-fixed load-lifting attachment(s)	m_{NA}	Gripping device	—	—	Grab[2]	Hook, beams and slings[2]
			Payload	m_{PL}	Dressed stone	Dressed stone	Contents of grab	Contents of grab	Box and contents
m_{GL}	m_{HL}	m_{NL}							

1) These components are permanently fastened to the ropes.

2) These components are not permanently fastened to the ropes: the connection is easily detachable.


m_{GL}
m_{HL}
m_{NL}
m_{PL}

Gross load	Hoist medium			m_{HM}	Main hoist rope(s) and auxiliary hoist rope	Hoist rope(s)	Hoist rope(s)
	Hoist medium load	Fixed load-lifting attachment(s)		m_{FA}	Bottom block and hook	Gripping device	Gripping device
		Net load	Non-fixed load-lifting attachment(s)	m_{NA}	Ladle	—	—
			Payload	m_{PL}	Contents of ladle	Ingot	Ingot
m_{GL}	m_{HL}	m_{NL}					


m PL
m NL
m HL
m GL

Gross load			Hoist medium	m_{HM}	—	Hoist rope(s)	Hoist rope(s)
	Hoist medium load		Fixed load-lifting attachment(s)	m_{FA}	Steering device and steering grab	Fork and vertical carriage	Headblock
		Net load	Non-fixed load-lifting attachment(s)	m_{NA}	—	—	Spreader
			Payload	m_{PL}	Contents of grab	Pallet with box	Container
m_{GL}	m_{HL}	m_{NL}					

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